NOTES FOR STUDENTS.

EBERHARDT[4] has performed a series of experiments with a view to finding the influence of dry and humid air on plant structures. These experiments in general confirm the work of Kohl and others. Humid air causes an increase in the length of the stem and the size of the leaf surface, while there is a decrease in the stem diameter, the amount of chlorophyll, and the root development. Dry air increases the thickness of the cuticle, the number of stomata, the woody tissue, the sclerenchyma, and the palisades.— H. C. COWLES.

SOME INTERESTING STUDIES have been made by Nestler[5] upon the well-known glandular hairs of *Primula obconica*. Physicians and gardeners have often asserted that this common primrose is poisonous, and Nestler has succeeded, not only in proving these statements, but also in localizing the poison. The glandular hairs contain the poison in the form of a yellowish green secretion; this when concentrated is very virulent, as the author discovered by testing the effect upon himself. The hairs of *Primula Sinensis* act in a similar way, but the poisonous effects are much less marked.—H. C. COWLES.

DR. G. KLEBS published last year[6] the third paper of a series on the physiology of reproduction in fungi in which he brings together the previous investigations with some hitherto unpublished researches, and seeks to present general considerations on the whole subject. The paper is full of suggestions and too valuable to mutilate by an attempt to summarize it. One general criticism lies against Klebs' work and his conclusions, namely, that he does not take into account sufficiently the effect of changes in osmotic pressure to which his experimental plants are subjected with the changing composition. It remains to be seen whether the conclusions are not vitiated by this untested factor.—C. R. B.

KEARNEY[7] discusses the Lower Austral element in the southern Appalachians. The mountains have representatives from all of Merriam's zones from the Lower Austral to the Hudsonian, though the Transition zone is most fully represented. Austro riparian colonies are found up to 1200 feet along the eastern boundary of Tennessee. Kearney divides the Austral mountain plants into those which are probably of neotropical origin and have come in since the ice age, and those which have probably descended from the Tertiary floras of northern regions. The plants of the first group are chiefly xerophytic, while those of the second group are mainly ligneous tropophytes. Lower Austral forms must have left the mountains during the

[4] Compt. Rend. **131** : 193–196, 513–515. 1900.

[5] Ber. deut. bot. Gesell. **18** : 189–202, 327–331. 1900.

[6] Jahrb. f. Wiss. Bot. **35** : 80–203. 1900.

[7] Science N. S. **12** : 830–842. 1900.

glacial period. Interesting hypotheses are given on the origin of the Austral forms.—H. C. COWLES.

MLLE. RODRIGUE[8] has made a painstaking study of the anatomy of variegated leaves with a view to ascertaining the relation between color and structure. The author gives an excellent summary of the literature of her subject, and makes a detailed study of thirty-three species. The white effect is due in most cases to the absence of chlorophyll, although a similar appearance is given by certain dissolved pigments, and by the reflection of light in some special instances. The modifications in the latter cases are slight and are confined to the epidermis. Where chlorophyll is absent, the leaf may be regarded as diseased, and the tissues are different from normal leaves, having no palisade development, and consequently a great reduction in thickness. In other words, the primitive tissues remain unchanged, where chlorophyll is absent.—H. C. COWLES.

ALB. NILSSON[9] has made some interesting studies on the dynamics of some Swedish plant societies, especially of cliffs and moors. He finds three types of cliffs, those which are forested either with conifers or deciduous trees, and those without trees. On all cliffs the first plants are crustaceous lichens. On the conifer cliffs there follow in succession fruticose lichens, herbs, heath plants, conifers. Cliffs with deciduous trees have no fruticose lichen or heath stages, the author attributing the absence of the fruticose lichens to wind. On the third type of cliff the lichens remain longer and foliose lichens and mosses are added to the stages after crustaceous lichens. Dying lakes pass into sedge moors, then into cotton-grass moors, finally into shrub moors and forest moors with pines or birches. Retrogressive phases are common on the moors, lichens growing over the peat moss and shrubs; again the water collects and the lichens pass away. The peat moss appears again and we have what Nilsson calls a secondary moor.—H. C. COWLES.

THE STYLIDIACEAE (Candolleaceae in Engler and Prantl's *Nat. Pflanzenfam*), a small family almost confined to Australia, New Zealand, and farther India, has been recently studied by G. P. Burns.[10] The greater part of the paper is devoted to a morphological study of the various tissues. Before fertilization the structures of the embryo sac present no unusual features, but immediately after the entrance of the pollen tube the micropylar portion of the sac grows out into an enormous haustorium much larger than the remainder of the sac. The endosperm forms rapidly and fills the sac with tissue before the first division of the egg takes place. Shortly after fertilization the antipodals disintegrate, and the posterior portion of the sac also

[8] Mém. l'Herb. Boiss. 17: 1900. [9] Bot. Not. 1899: 89–101; 123–135.

[10] Beiträge zur Kentniss der Stylidiaceen. Flora 87: 313–354. *pls. 13, 14* (and 45 text figures). 1900.

forms an haustorium. Finally, the protoplasmic contents of both haustoria become transformed into a network of cellulose threads which in case of the upper haustorium form a plug effectually closing the micropyle. The sac is surrounded by a jacket or "tapetum" which is even more conspicuous than in the Compositae.—CHARLES J. CHAMBERLAIN.

THE FUNCTION of latex, so often in past years a motive for investigation, has again been made a subject for study. Gaucher[11] gives a historical summary of the two chief views, excretory and nutritive, from the time of Trécul to the present. The author gives no new theories, but presents a large number of facts which favor the nutritional function, very much as presented by Haberlandt. The substances contained in latex, the connection between the latex tubes and the palisade, and the reciprocal relations between latex tubes and conductive parenchyma are all studied, and Gaucher in these cases confirms and extends Haberlandt's observations. In one instance he finds a ring or festoon of chlorophyll cells arranged about a latex tube.

Parkin[12] has studied the latex in rubber plants of Ceylon, and holds a somewhat intermediate view. While he regards the proteids of latex as probably nutritive, he does not so regard the starch, unless perhaps the latter aids in the nutrition of the latex tubes themselves. The author finds that the latex flows far less abundantly at the first tapping than subsequently, showing an apparent adaptation. Parkin regards the chief function of latex to be water storage.—H. C. COWLES.

SOME VALUABLE CONTRIBUTIONS to the literature of forest distribution have been made recently by the United States Geological Survey.[13] This report is under the supervision of Henry Gannett, chief of the division, and is a companion volume to a similar one published last year. It contains special considerations of the Pike's peak, Plum creek, and South Platte reserves by John G. Jack; White river plateau timber land reserve by George B. Sudworth; the Flathead forest reserve by H. B. Ayres; and the Bitterroot forest reserve by John B. Leiberg. Topographic features, soil conditions, climate and rainfall, forest conditions, fires, and lumbering are some of the topics treated in these reports. A large number of plates, including both maps and reproductions from photographs, are incorporated in the volume, and a portfolio containing topographic maps showing distribution of timber areas presents the subject in a graphic way.

If the department would but incorporate in its excellent geological and physiographical atlases an additional topographic map showing the distribution of forest and other floral areas, including descriptions of the edaphic and climatic conditions, it would add much to their educational, economic,

[11]Ann. Sci. Nat. Bot. VIII. **12**: 241–260. 1900. [12]Ann. Bot. **14**: 193–214. 1900.

[13]*Twentieth Annual Report, U. S. G. S.*, Part V. Forest reserves, pp. xviii + 498. *pls. 159*. 1898–9.

and scientific value. Some such careful study of a large number of floral areas is an absolute necessity to a correct understanding of the complex climatic and ecologic factors governing the distribution of trees. Indeed, in the last atlas[14] issued by the department an approach has been made to such a realization. This atlas contains a brief summary of the vegetal and climatic features, a map of the floral features, and three maps showing precipitation, evaporation, and types of rainfall.—H. N. WHITFORD.

THE STUDIES of Brenner[15] on succulent plants must prove of great interest to all physiologists and ecologists. His work was experimental and for the most part on the Crassulaceae and Mesembryanthemum. After a discussion of the normal anatomy, he describes the effects produced on succulent plants by moist air. The most striking effect in Sedum is pronounced internodal elongation, which the author refers to the increased turgor incident to lessened transpiration. At first the leaves are fleshy, but later leaves are larger and thinner and placed like normal fleshy leaves in dry air in the form of a rosette. There is thus a striking correlation between stem elongation and leaf form. Another effect of moist air on the leaves is epinasty, so that the new leaves place themselves at right angles to the stem; when these plants are placed in a dry chamber hyponasty is shown. Notable changes in anatomy are also induced. In two plants the normally straight side walls of the epidermis become wavy, and doubtless give greater mechanical strength to the otherwise weakened leaf. The tangential increase of the epidermal cells as against the radial is very noticeable, though Brenner is at a loss to find a physical explanation therefor. The stomata at first are the same in number as on normal leaves, though of course they are farther apart, since the leaf is larger. On later leaves the stomata are more numerous though the number per unit area may be much as in normal leaves. There is a decrease of the storage tissue and an increase of the chlorophyll tissue, though the cells in the latter tissue are more nearly isodiametric than in dry air. The vascular system and air spaces are decreased in moist air; the reduction in the bundles is rather in number of cells and ramifications than in cell size. The author finds the dry weight and ash and also the acid content to be less than in normal plants. At first moist air increases the size of the chloroplasts, though they decrease in size later, pointing to an apparent readjustment to the new conditions.

Various comparative physiological experiments were made on plants grown in dry and moist air. In Mesembryanthemum nutation movements were noticed in the latter but not in the former. Normal leaves in normal air transpire the same per unit area as do moist-air leaves in moist air, though the leaf form is very different. This observation is very instructive

[14] HILL, ROBERT T.: Topographic atlas of the Texas region, pp. 12. *pls. 11.* 1900.

[15] Flora **87**: 387–439. 1900.

as it shows strong powers of readjustment in such highly specialized forms as succulent plants. The author concludes by saying that the air and not the soil relations are determinative for the above changes. This is in harmony with Kohl's results on Tropaeolum. Brenner thinks that the phenomena which he observed are in a high degree purposeful, and that purely physical explanations are very difficult at many points.— H. C. COWLES.

ITEMS OF TAXONOMIC INTEREST are as follows: ARTHUR MINKS (Mém. Herb. Boiss. 22: 1–74. 1900) has published a full discussion and synopsis of the genus *Umbilicaria*.— WILLIAM R. MAXON (Proc. Biol. Soc. Washingington **13**: 199, 200. 1900) has described a new *Polypodium* (*P. hesperium*), which is "the common form of the whole mountain region of the western United States." The same author (Bull. Torr. Bot. Club **27**: 638. 1900) has described a new *Dryopteris* from Alaska.— P. A. RYDBERG (Bull Torr. Bot. Club 27: 614–636. 1900), in continuing his "Studies on the Rocky mountain flora," has published an account of some of the smaller genera of Compositae. Those considered are *Stenotus*, formerly a section of Aplopappus, containing seven species, of which two are new; *Stenotopsis*, a new genus established on *Aplopappus* (*Stenotus*) *linearifolius*, and including also *Aplopappus* (*Stenotus*) *interior; Macronema*, containing seven species, of which one is new; *Sideranthus*, a genus revived to include species formerly under Aplopappus, and more lately under Eriocarpum, and which is recognized as containing seven species, three of which are new; *Pyrrocoma*, with sixteen species, five of which are new; *Balsamorrhiza*, with nine species, two of which are new; *Thelesperma*, with seven species, two of which are new; *Hymenopappus*, with eight species, four of which are new.— EDWARD L. GREENE (Pittonia **4**: 159–226. 1900) has recently made some important contributions as follows: A fascicle of new forms of *Arnica* contains twenty-four species; Gentianaceae are enriched by three new species of *Gentiana*, three of *Swertia*, and three of *Frasera;* the third of the "Studies in the Cruciferae" discusses certain species of *Arabis*, describing seventeen as new, describes new species in *Cheiranthus*, *Sophia*, *Thelypodium*, *Thysanocarpus*, *Draba*, and *Cardamine* (4 spp.), expresses his conclusion as to the type of the genus *Draba*, and establishes a new genus (*Abdra*) upon what is known as *Draba brachycarpa;* the second of the papers on "Neglected generic types" brings to us *Halerpestes* as a new genus established to include *Ranunculus Cymbalaria* Pursh, *R. salsuginosus* Pallas, and *R. tridentatus* HBK., *Peritoma* DC. to include certain species of Cleome (*serrulata*, *inornata*, *lutea*), *Celome* founded on *Cleome platycarpa* Torr., *Carsonia* founded on *Cleome sparsifolia*, and *Aldenella* founded on *Polanisia tenuifolia* T. & G.; eighteen new species are added to the genus *Aster*, all but one of which are from the Rocky mountains; among the "Corrections in nomenclature" *Oreostemma* is substituted for the untenable *Oreastrum* Greene (containing certain species formerly referred

to Aster), *Nerisyrenia* is substituted for the untenable *Parrasia* Greene (Greggia), and *Eremosemium* is substituted for *Grayia* of the western deserts on account of a prior use of the name. The same author (*idem* 227–241. 1901) has begun the segregation of *Taraxacum* in North America by describing eight new species; and has described new species under *Thalictrum*, *Rumex* (2), *Lappula*, *Allocarya* (2), *Solidago*, *Coleosanthus* (5), *Coreopsis*, *Parthenium*, *Picradenia*, and *Zygadenus* (2).— M. L. FERNALD (Rhodora **2**: 230–233. *pl. 21.* 1900) has described two new northeastern species of *Thalictrum*, and two new varieties of *Scirpus maritimus* (*idem* 241. 1900), and has presented (*idem* **3**: 13–16. 1901) *Monarda fistulosa* and its allies.— B. L. ROBINSON (Rhodora **2**: 235–238. 1900) has discussed and reorganized the nomenclature of the New England representatives of *Agrimonia*, has presented (*idem* **3**: 11–13. 1901) the results of his search for the type of the Linnean *Gnaphalium plantaginifolium* which proves to be *A. plantaginea* as interpreted by Fernald, and has discovered (*idem* 16–17. 1901) that *Sisymbrium Niagarense* Fourn. should be transferred as a doubtful synonym under *S. officinale* L. to *Brassica nigra* Koch.— G. E. DAVENPORT (Rhodora **3**: 1–2. *pl. 22.* 1901) has described a new plumose variety of *Asplenium ebeneum* from Vermont.— J. M. GREENMAN (Rhodora **3**: 3–7. 1901) has set forth the genus *Senecio* as it exists in New England, describing two new varieties of *S. Balsamitae*.— SPENCER LE MOORE (Jour. Bot. **38**: 457–469. *pl. 416.* 1900) has described two new genera of Compositae from Africa (*Delamerea* and *Nicolasia*), both belonging to the Inuloideae — A. B. RENDLE (Jour. Bot. **39**: 12–22. 1901) has described eleven new species of *Ipomoea* from Africa.— F. LAMSON-SCRIBNER and ELMER D. MERRILL (U. S. Dept. of Agric., Div. of Agrost. Bull. **24**: 1–54. 1901) have published new species of *Tripsacum*, *Andropogon* (3), *Paspalum* (2), *Panicum* (3), *Muhlenbergia*, *Agrostis*, *Tristachya*, *Leptochloa*, *Aristida* (2), and *Elymus* (5); and have given the results of a study of the types of *Panicum nitidum*, *P. pubescens*, and *P. scoparium*.— J. M. C.

IN A RECENT PAPER Hans Fitting[16] has given the results of his investigations on the mode of origin of the megaspores, and the development of their coats in Isoetes and Selaginella. His work was done chiefly with living spores examined in a physiological salt solution, and in water. Microtome sections were used to trace the phases of karyokinesis in the spore mother cells, and for a check on the conclusions drawn from the living material.

He agrees with Smith[17] in his account of the origin of the sporangium of Isoetes. It will be remembered that the latter author differed from Goebel, Bower, and Campbell, in asserting that "the rudiment of the sporangium is

[16] Bau und Entwickelungsgeschichte der Makrosporen von Isoetes und Selaginella, etc. Bot. Zeit. **58**: 107–164. *pls. 5–6.* 1900.

[17] BOT. GAZ. **29**: 225–258, 323–346. *pls. 12–20.* 1900.

a transverse row of superficial cells below the ligule." Also, as regards the formation of the trabeculae and tapetum, Fitting's account is identical with Smith's.

The spore mother cell is distinguished by its finely granular protoplasm, large nucleus, and nucleolus. At one side of the nucleus lies a dense mass of coarse-grained protoplasm, in which are imbedded many small starch grains. Preceding the first division of the mother cell, radiations appear in the protoplasm, extending in all directions to the wall, but from no common center. The mass of mingled protoplasm and starch divides into two nearly equal parts, and new radiations appear between them as they separate. They finally take the positions of two foci of an ellipse, the spore mother cell being nearly of that shape. During this process the nucleus has shifted from the center to the periphery of the cell, and at its conclusion has returned to its original position. The two daughter masses (*Tochter-Klumpen*) elongate and lie in planes at right angles to each other and to the long axis of the cell. The starch grains arrange themselves in straight lines in each mass. Those near the middle slip toward either end and reunite in two groups, surrounded by the dense protoplasm. This process results in four masses of starch surrounded by the coarse granular protoplasm, arranged tetrahedrally. These changes the author followed in living material, observing the spore through the sporangium wall and the several layers of sterile cells, tapetum, etc. The nucleus then divides by two rapid successive divisions, the spindle lying in such fashion that each of the four daughter nuclei lies by one of the *Tochter-Klumpen*. New fibers arise from the surrounding protoplasm and extend themselves between the nuclei, thus forming a sextuple spindle. Equatorial cell-plates cross these spindles, cutting completely through the protoplasm in six planes from the center of the cell to its wall. Partition walls develop in these plates. It is evident that four of these walls have no connection with the spindles concerned in the division of the nucleus.

The origin of the four megaspore membranes is worked out with great detail. The main points are as follows: While the four "special mother" cells are still lying in the form of a tetrad enclosed by the mother cell membrane, each surrounds itself with a separate membrane called the "special mother cell" membrane. The author did not determine whether this was formed by the mother cell membrane or by the protoplasm of the special mother cell. This thickens rapidly and divides into three lamellae which taken together constitute the *exospore*. Between the exospore and the protoplasm of the cell (now called megaspore) developing from the latter, appears the *mesospore*. The outer layer of the exospore becomes roughened with spines or reticulations, and following their exact contour is laid down an incrustation with much silica, which Fitting styles the *perispore*. Some species of

Isoetes lack this coat. All of these membranes grow by intussusception, and the author lays stress on the fact that the perispore and exospore are of quite different chemical nature, and yet are both growing simultaneously by intussusception. Finally, between the mesospore and the protoplasm content appears a thin film of cellulose, the endospore. The nourishment needed for the growth of these membranes is derived from the sporangium wall and trabeculae, not from the tapetal cells. Until the walls are formed the spore content is relatively very small.

The author was less successful in his work in Selaginella. Owing to the smallness of the megaspore and to imperfect technique (he never succeeded in avoiding shrinkage) he failed, like all his predecessors, to make out the stages of the development of the megaspore. The megaspore mother cell is easily recognized, but how it divides into spores is not known.

Heinsen's account and Fitting's disagree in almost every particular as regards the interpretation of the spore contents and the origin of the several coats. The "nucleus" (according to Heinsen) is the entire protoplasmic content. Heinsen's "nucleolus" Fitting interprets as the nucleus. The several small "corpuscles," whose nature Heinsen could not explain, are, according to this author, the nucleoli. The sequence of events as regards the development of the coats is much like that of Isoetes, making an additional reason why Isoetes and Selaginella should not be separated in any system of classification. The author thinks that the extremely small amount of protoplasm in the spore can have nothing to do with the nourishment of the spore coats, which soon far exceed it in thickness and bulk. Between the tapetum and the four megaspores is a sort of slimy matter which Bower interpreted as the remains of the disorganized sterile mother cells. Fitting says that these cells do not disorganize, and that the slime is a secretion from the tapetum, which acts like a gland. This material nourishes the spores up to their maturity, when they fill the entire sporangial cavity. Like those of Isoetes, the spore walls develop by intussusception. A very significant fact is that the greatest growth of the spore walls takes place when they are not in contact with the plasma body within. Four walls are found, exospore, mesospore, endospore, and perispore (the latter sometimes lacking in certain species). The increase in size of the plasma body without corresponding increase in the amount of matter of which it consists, followed by cell division and the formation of the prothallium, were not followed in detail. The author says, however, that in some species this occurs before the spores are shed (*S. Martensii, S. Galeottii*), and in others "a long time afterward."—Florence May Lyon.